Standard Service

ELECTRIC ~~SHIP~~ PROPULSION MACHINERY

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INSTALLED ON

MOTOR SHIP "STANDARD SERVICE"

FOR

THE STANDARD OIL COMPANY OF CALIFORNIA

GENERAL ELECTRIC COMPANY
SCHENECTADY, NEW YORK

INSTRUCTION BOOK 89029

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GENERAL ELECTRIC COMPANY
Schenectady, N. Y.
March, 1923

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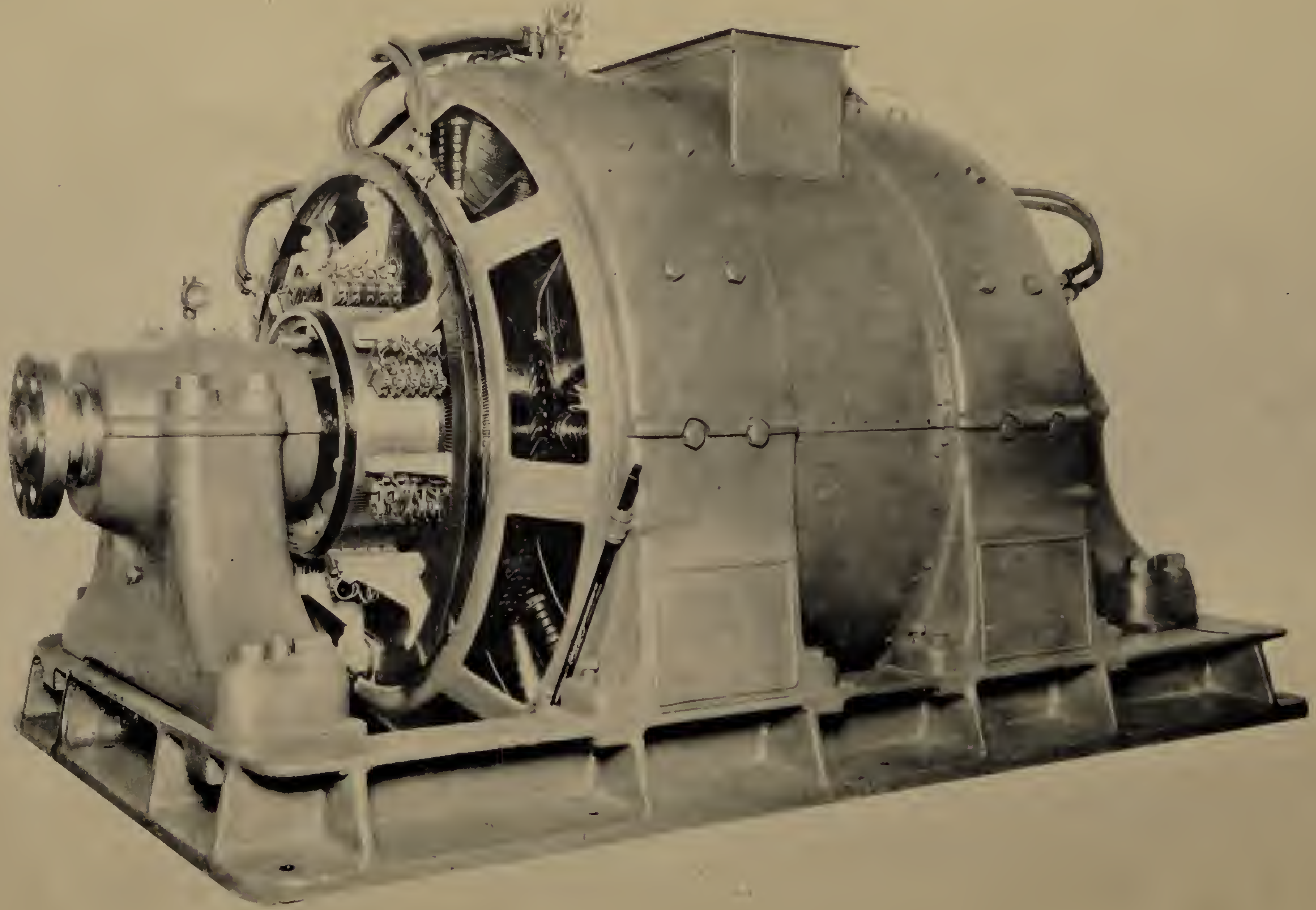

402483 TWO MPC-6-300 HP-130-230 V. S. W. MOTORS. 600 HP PROPULSION MOTOR FOR STANDARD OIL TANKER.

INDEX E-311.4

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ELECTRIC SHIP PROPULSION MACHINERY INSTALLED ON MOTOR SHIP "STANDARD SERVICE" FOR THE STANDARD OIL COMPANY OF CALIFORNIA

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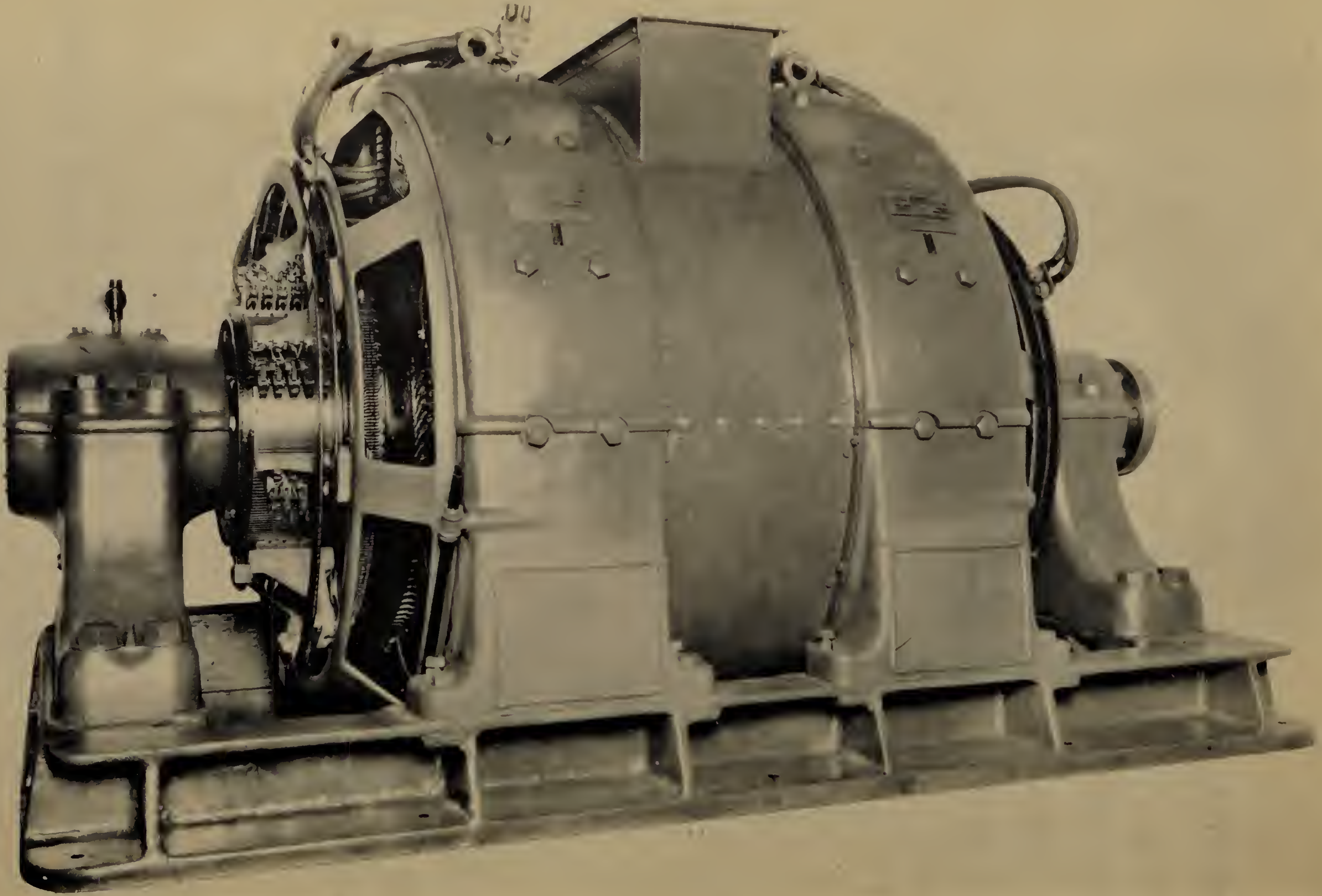

402482 TWO MPC-8-300 HP-130-230 V. S. W. MOTORS. 600 HP PROPULSION MOTOR FOR STANDARD OIL TANKER.

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ELECTRIC SHIP PROPULSION MACHINERY

Installed on Motor Ship "Standard Service"
For the Standard Oil Company of California

INTRODUCTION

This book is published primarily to assist the engineer in the successful operation of the Electric Propulsion Machinery manufactured by the General Electric Company for the above Tanker. Inasmuch as intimate knowledge of the construction of generators, motors, and control equipment is an aid to their proper care and operation, general instructions are here given, with references to the working drawings where necessary for the purpose of clearness.

This instruction book furnished with the Electric Propulsion Machinery should be regarded as a general guide, and the recommendations given must not be taken as sufficiently explicit to cover every detail. Any specific information not contained in this instruction book may be obtained from the nearest marine representative of the General Electric Company, (see list of marine representatives in the back of the book.) In the event of operating difficulties requiring unusual repairs of re-adjustments, notify the nearest district office or representative of the General Electric Company, a list of which is given on the last page. Inspectors to examine marine installations and skilled construction foremen are promptly available upon request.

The General Electric Company shall not be held responsible for work done, apparatus furnished, or repairs made by others.

GENERAL DESCRIPTION

The Electric Propulsion machinery herein described consists of two direct-current generators rated MPC-8-245 Kw. 265 r.p.m.-230 volts, each direct connected to a 400 B.H.P. Pacific-Werkspoor Diesel engine supplied by the customer; two exciters rated MPC-6-30 Kw.-265 r.p.m.-115 volts, each mounted on a generator shaft extension; two motors rated MPC-8-300 HP-130 r.p.m.-230 volts, connected in tandem to the propeller shaft; one CES-82A Engine room control panel; one CES-83A Pilot house panel; and one controlling rheostat located in the engine room but also operated manually from the pilot house.

In addition to the propulsion equipment the engine room is equipped by the customer with an auxiliary generator for lighting purposes only and the necessary switch panels for operating the various pumps and auxiliary apparatus, and also for lighting. (See the system wiring diagram in the back of the book.) The two main generators are used for supplying either the main propelling motors or the cargo pump motors with power. The two 30 Kw exciter supply current for excitation and control of the propelling machinery and also for lighting and the ship's auxiliaries.

MAIN GENERATORS

Each of the two main generators for supplying current to the main propelling motor is differentially compound wound and is rated MPC-8-245 Kw.-265 r.p.m.-230 volts.

The magnet frame is split horizontally and the brush holder rigging is supported in a rabbet groove in the side of the frame. The generator is furnished without shaft or bearings as it is mounted by the customer on a bed plate bolted directly to the engine bed plate and both fitted on a common seating. After the armature is properly assenbled on the shaft, the magnet frame should be carefully aligned and fitted so that the air gap between the armature and the pole pieces will be uniform around the entire periphery. Jacking screws in the feet of the frame are provided to adjust the frame during alignment.

A tap is taken off the line of each generator from between the differential series field and commutating field circuits for the purpose of supplying power to the cargo pump motors without being affected by the differential series fields.

Instruction-Book 80026-A can be followed generally with respect to information regarding handling, initial starting, operation, care, troubles, and repairs The method of installing does not apply in this case however as the installation of Marine generators differs from that of land installation. The foundation seatings should be sufficiently rigid and properly stiffened with gussets to prevent any twisting moments which might cause misalignment of the engine and generator.

EXCITERS

An exciter rated MPC-6-30 KW-265 r.p.m.-115 volts is mounted on the generator shaft of each main unit. It is similar in construction to the main generator, being compound wound and having the brush holder rigging supported in a similar manner. The suggestions given under "Main Generators" and references to Instruction Book 80026-A apply equally to the exciters. The wiring from the exciters is connected to the Exciter and Auxiliary Generator Panel through a system of switching which enables either or both exciters to supply excitation current and auxiliary power respectively. See the main wiring diagram in the back of the book.

MAIN PROPELLING MOTORS

The propelling motors photographs 402482 and 402483, are mounted on a common base, the armatures being mounted with the commutators outermost on a single shaft which is supported by two spherical seat self aligning (~~oil ring~~) FLOOD LUBRICATION type bearings which are bolted to the base. Each motor is rated MPC-8-300 HP-130 r.p.m -230 volts, thus giving a total of 600 horsepower for driving the propeller. Ventilation is provided by forcing clean air into the chamber formed by the sheet steel casing which connects the two magnet frames, the air passing over the armatures and fields and finally out over the commutators.

The magnet frames are aligned on the base by means of four jacking screws in the feet of the frame. These screws are used to raise the frame of the motor while adjusting shims under the feet and should be relieved when this purpose is accomplished. When properly aligned the air gap between the pole pieces and the armature should be uniform around the entire periphery. Under the foot of each bearing pedestal is an insulating fibre washer to protect the journals and bearings from stray currents.

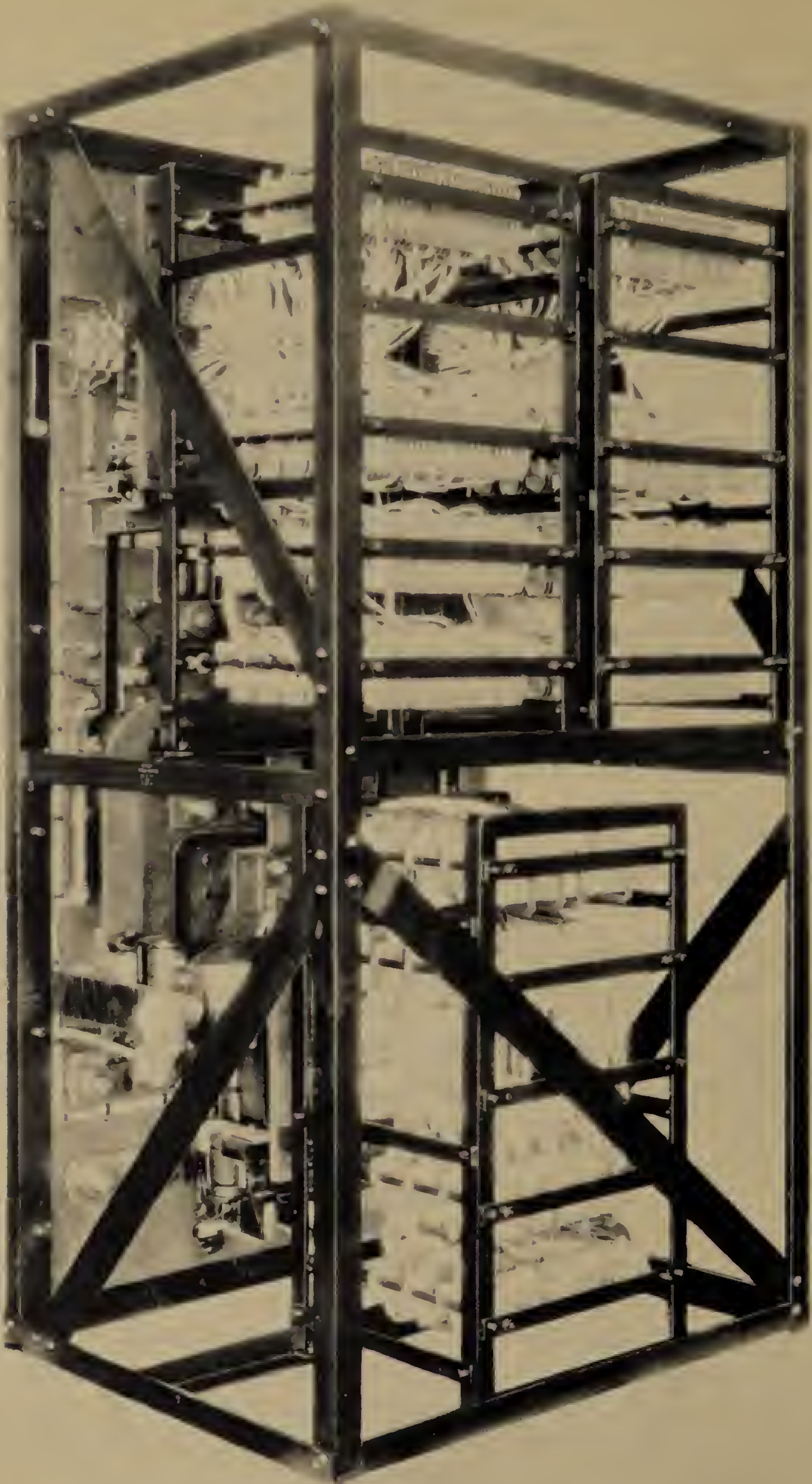
The complete motor assembled on the base is secured to the machinery foundation seatings after being properly aligned with the propeller shaft. The foundation bolts and chocks should be carefully fitted so as to preserve the alignment of the motor and propeller shafts at all times.

Instruction Book 81028 can be followed generally with respect to information regarding initial starting, operation, care, troubles, and repairs. The method of installing should be disregarded as it applies to land machines. The general instructions given above should be followed instead.

CONTROL EQUIPMENT FOR THE ELECTRICALLY PROPELLED TANKER FOR THE STANDARD OIL COMPANY OF CALIFORNIA

The main control equipment provided to control the operation of the two Diesel engine-driven generators and the main propelling motor consists of an engine room control panel on which are installed the various switches, field rheostats, instruments, contactors and relays; a pilot house panel carrying instruments for indicating propeller speed, line amperes, and motor field amperes; a controlling rheostat for varying and reversing the shunt field current of the two generators; and one propeller speed magneto connected electrically to the speed indicators on the panels.

The switches and wiring are so arranged that either one or both generators can be used to supply line current to either one or both motors which comprise the main propelling motor. The generators can also be used to supply power to the cargo pump motors. The switches on the cargo pump panel are so arranged that any pump motor can be supplied by either generator



402502 CES-82A PANEL.

APPROX. 1/12 SIZE INDEX E-354.9 12 16 22

All this control equipment, excepting the pilot house panel and telltale board, is installed in the engine room and consists of the following:

1 – CES-82A Control panel
1 – CES-83A Pilot house panel
1 – CR 8020 Controlling rheostat
2 – Generator field adjusting rheostats
1 – M 300 propeller speed magneto
1 – Magneto connection box with transfer switch

Additional equipment supplied by the customer consists of the following: (See wiring diagram)

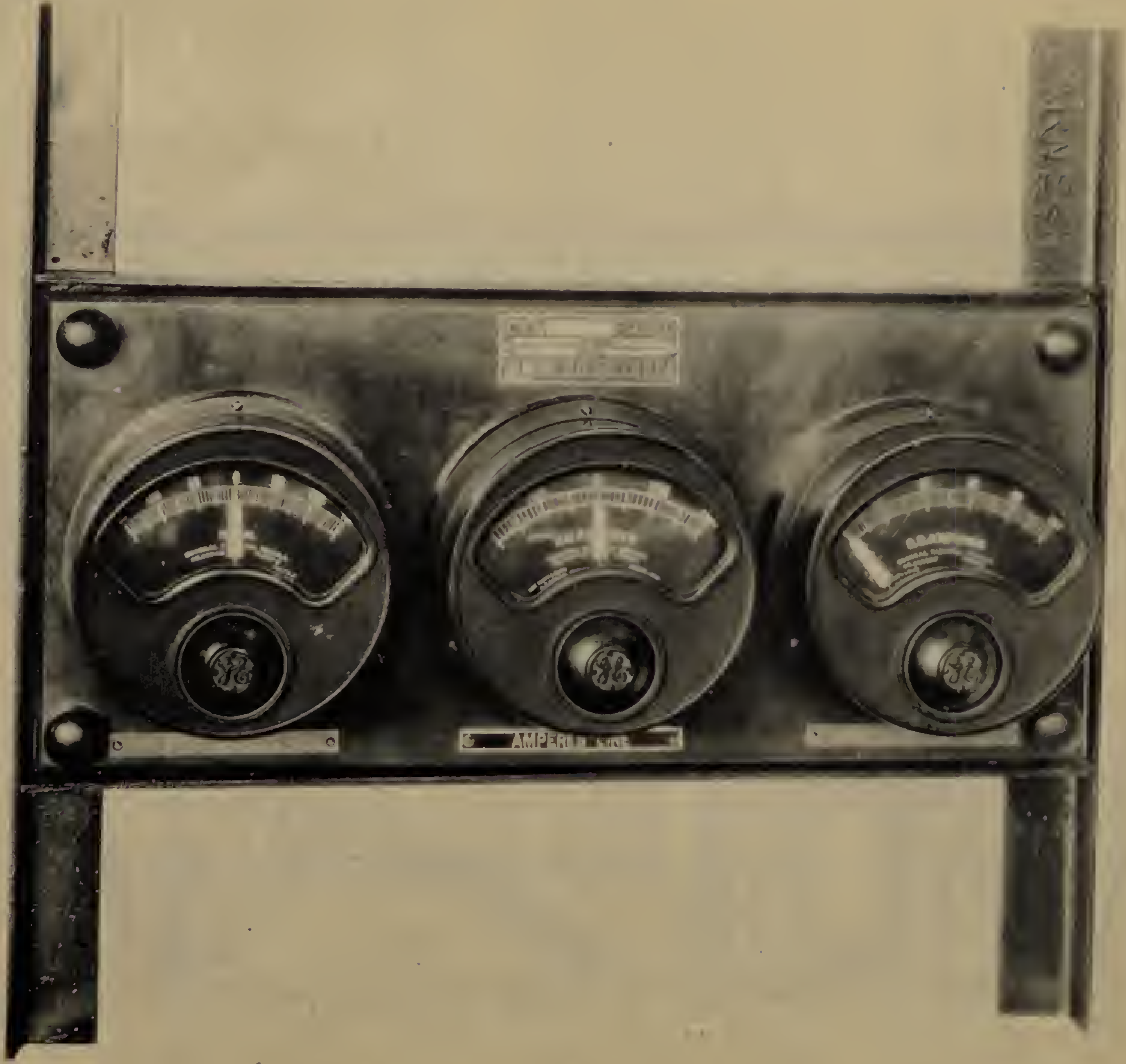
Cargo pump panel – 230 volt
Exciter and auxiliary generator panel – 115 volts
Lighting and auxiliary distribution panel – 115 volts
Auxiliary lighting panel
Telltale board

CES-82A ENGINE ROOM CONTROL PANEL

On this control panel, photographs 402501 and 402502, and wiring diagram P-2191313, are mounted the engine room instruments; the generator and motor cutout switches, the field switches, and the excitation switch; and the motor field and generator field rheostats which set in the frame of the panel. The necessary instrument shunts and field discharge resistances are mounted on the back of the panel as also are the generator field contactor and overload relay.

The instruments are located at the top of the panel and are built for marine use, being equipped with non-corrosive parts. The dials are white with black markings. There is one voltmeter having a 300-0-300 scale which can be made to indicate the voltage of either generator by means of a voltmeter switch. A motor field ammeter with a 0-100 scale indicates the sum of the current through both motor fields which are connected in parallel. A line ammeter with a 2000-0-2000 scale indicates the amount of current flowing through the propelling motors irrespective of the arrangement of the line switches. A speed indicator having a 150-0-150 r.p.m. scale indicates the speed of the motor either ahead or astern. An ammeter having a 100-0-100 scale indicates the sum of the current through the generator fields whether the generators are supplying current for propulsion or for the cargo pumps.

Two generator field rheostats are mounted on the angle iron framework of the panel and are used to regulate the voltage of the generators when supplying current to the cargo pump motors. The motor field rheostat is of the same type and is similarly mounted. Two adjusting rheostats not mounted on the panel are used to adjust the generator fields when using the generators for supplying current for propelling the boat..



402500 APPROX. 1/4 SIZE

CES-83A PANEL.
INDEX E-354.9

12 16 22

There are four double-pole, double-throw, 1200 amperes, 250 volt switches provided to connect either or both generators in series with either or both motors. In the "up" position both motors and generators are connected together in series. Throwing any switch to the "down" position removes that particular motor or generator from the circuit, but leaves the circuit intact.

Alongside of each generator disconnecting switch is a double-pole, double-throw 200 ampere, 250 volt switch for changing the generator field circuit from the controlling and adjusting rheostats to the regulating rheostats when using the generators for supplying current to the cargo pumps. Two double pole, single throw, 100 ampere, 250 volt motor field switches along side of the motor disconnecting switches are mechanically interlocked with their respective line switches so that the motor field circuit can not be opened without first opening the line switch, also the line switch can not be closed unless the field switch is first closed. A double-pole, single throw, 200 ampere, 250 volt switch is provided to connect the excitation and control circuits with the 115 volt excitation bus on the Exciter and Auxiliary panel. This switch, as well as the two generator field switches, is provided with a discharge resistance mounted on the back of the panel.

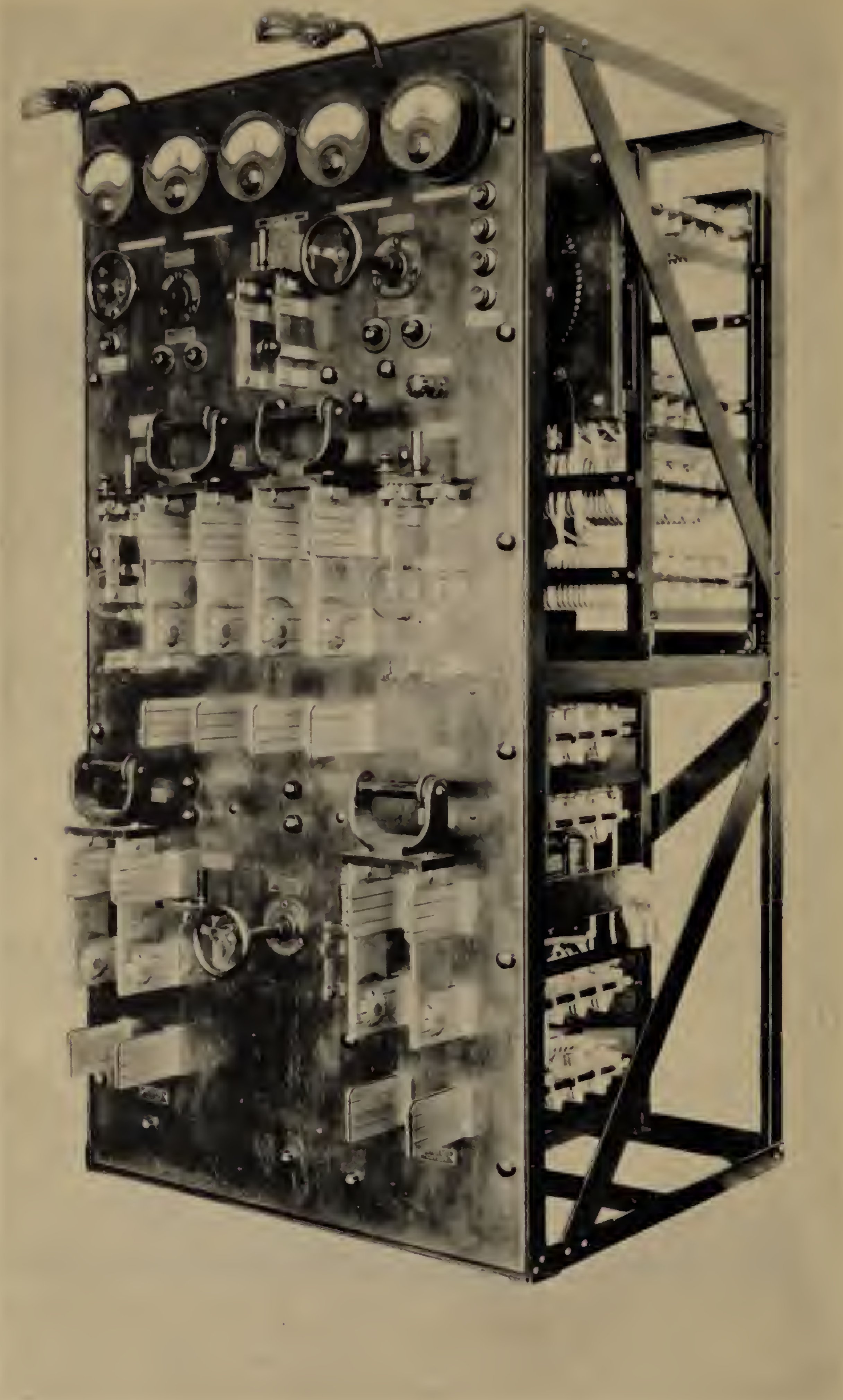
THE DISCONNECTING SWITCHES SHOULD NOT BE OPERATED UNLESS THE HANDLE OF THE CONTROLLING RHEOSTAT IS IN THE "OFF" POSITION AND THE EXCITATION SWITCH OPEN.

NO WORK MUST BE DONE ON THE MOTORS OR GENERATORS UNLESS ALL SWITCHES IN THEIR IMMEDIATE CIRCUIT ARE IN THE "OPEN" POSITION.

CONTACTOR AND RELAY

The DB 285-A5 contactor, shown in photograph 402502, is installed in the excitation circuit of the generator fields and is operated by means of a magnetic solenoid which is energized when the excitation switch is closed and the overload relay is in the "reset" position.

The DB-811-B3 overload relay, shown in photograph 402502, consists of a series coil with armature and a shunt coil with a plunger carrying two disk interlocks. When the relay is in the tripped position, the lower disk closes a circuit through the shunt coil of the relay, which circuit is completed when the controlling rheostat is in the "off" position. (See wiring diagram P-2191313). The completion of this circuit picks up the plunger of the relay so that it is latched in the "up" position thereby closing the upper disk interlock which is in the solenoid circuit of the generator field contactor. This solenoid circuit is complete at all times when the upper disk interlock is closed, providing that the excitation switch is closed.



402501 CES-82A PANEL.
APPROX. 1/12 SIZE INDEX E-354.9 12 16 22

In case of overload the excessive current through the series coil of the relay picks up the armature, thereby tripping the latch which holds in the "up" position the plunger carrying the disk interlocks, thus causing the solenoid circuit to be opened which opens the generator field contactor, and relieves the generators of their load.

The controlling rheostat handle must be moved back to the "off" position to reset the overload relay.

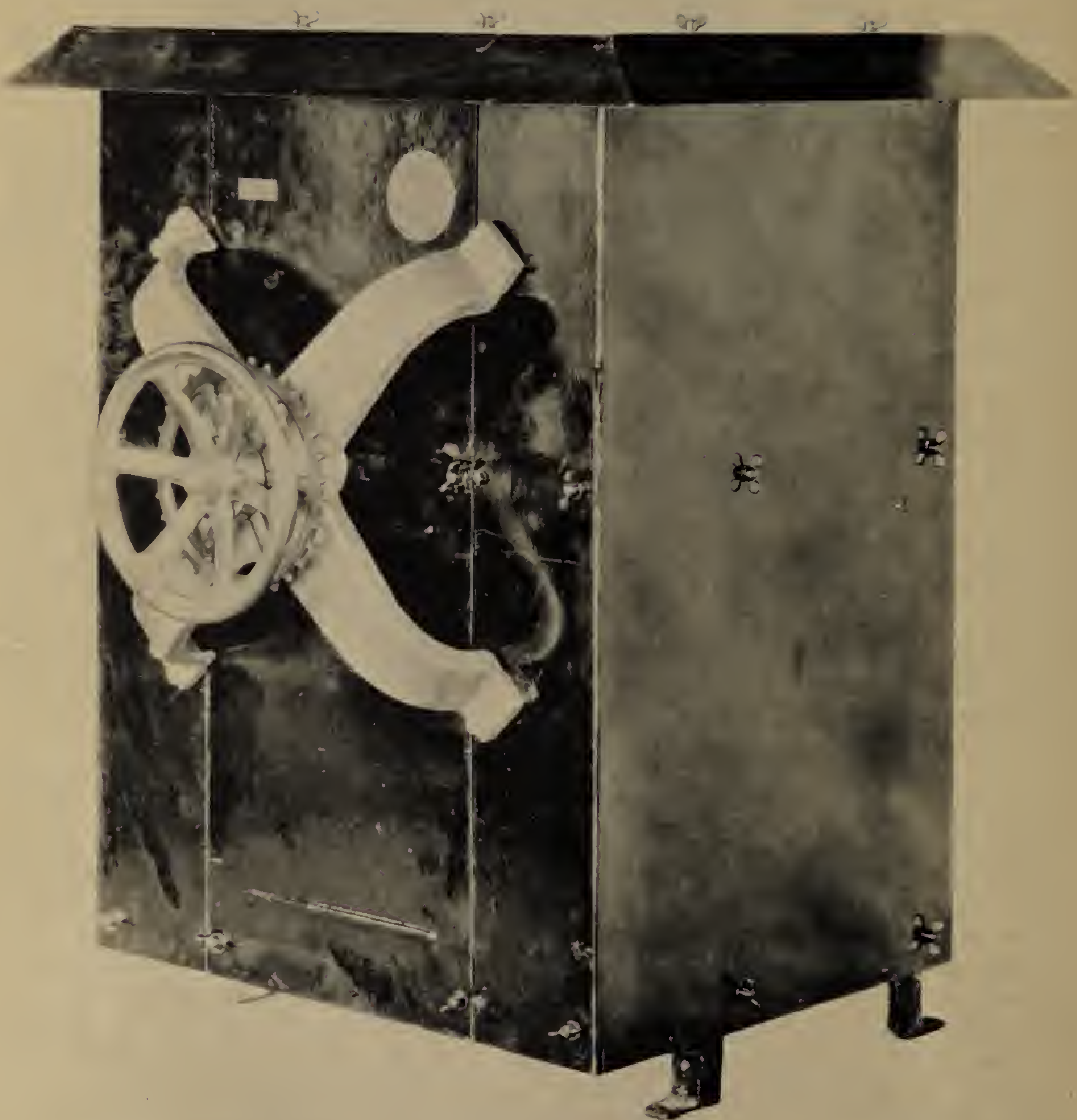
CES-83A PILOT HOUSE PANEL

The pilot house panel, photograph 402500 has three instruments; a speed indicator, motor line ammeter and motor field ammeter, similar to those mounted on the Control Panel in the engine room. The scales of these instruments are black with white markings.

CONTROLLING RHEOSTAT

The controlling rheostat shown in photographs 147821 and 147822 is supported by an angle iron frame, and consists of a sheet metal box in which is mounted a dial switch on an ebony asbestos base. The wire and ribbon wound resistors are back of this base and taps taken off at proper intervals are connected to the contact segments which set in the base. The handle is connected to the contact arm by means of a shaft on which is mounted a gear which is driven from the pilot house. This gear can be released when it is desired to operate the controller from the engine room. The contact arm is provided with five cylindrical copper plungers which travel over the segments and rings mounted on the base.

Good electrical contact for the plungers is insured by coiled springs which press the plunger firmly against the segments and rings as the contact arm is moved to the different positions. The five plungers travel over five concentric rings, which, for clarity of explanation will be referred to by number, the outer ring being designated as the first. The outer or first ring consists of a series of brass segments to which are connected the taps from the generator field controlling resistor. See drawing P-2191313. Referring to the diagram of the controlling rheostat as shown on this drawing, the path of the current is as follows:- Terminal No. 1 is supplied by one side of the excitation switch and the current then goes from terminal No. 1 to the top center segment of the outer ring. From here it is carried through two paths to terminal No. 2. In one path it is carried directly through the resistance elements to terminal No. 2; in the other path it is carried to the fourth ring in through the plunger in the contact arm and out again on the third ring which is semi-circular and connected to the fourth ring. This half of the fourth ring is connected to terminal No. 3, which is connected through field



147821 CR-8020 CONTROLLING RHEOSTAT. DL-2091981. FOR BOAT CONTROL. OUTLINE K-2092439. CONNECTIONS K-2092434. WITH COVER.

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switches to the generator fields from which the current returns to terminal No. 4 which is connected to the other half of the fourth ring. From this ring the current is carried through the outermost plungers of the contact arm to the segments of the first ring, from which it passes through the resistance of the controller to terminal No. 2 and back to the other side of the excitation switch through the field contactor. This completes the circuit for operating the boat in one direction. For reversing the direction, the contact arm is swung to the other side of the neutral position, which results in changing the flow of current through the generator fields by reversing the connection to terminals No. 3 and 4. For setting the overload relay, the fifth ring, consisting of a ring of fibre with a single contact segment connected to terminal No. 5 completes the circuit of the relay coil when the controller contact arm is in the neutral position only.

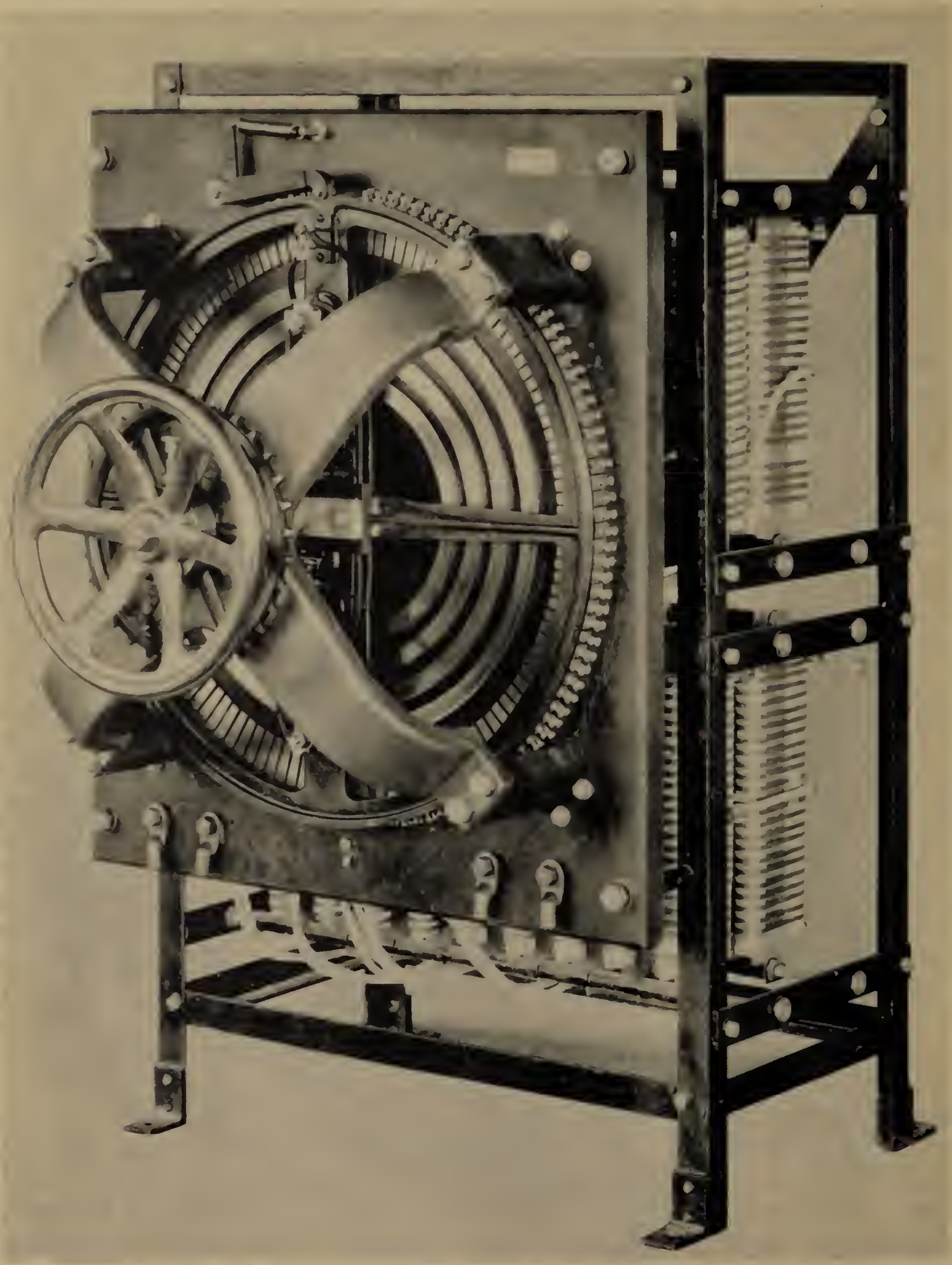
The controlling rheostat is designed to give the operator a simple, quickly responsive means of starting, stopping, and reversing the boat. It should always be left in the "off" position (position where the first ring plunger makes contact with the top center segment) when not in use. Since there is always full excitation voltage across the resistance element of the rheostat when the excitation switch is closed, the first effect of moving the contact arm to the right or left of the "off" position is to excite the fields of the generators. Moving the arm still further increases the voltage on the generator fields by decreasing the effective resistance in the circuit. Moving the control handle to the right of the neutral position gives a definite polarity to the generator fields, which is reversed by moving the handle to the left. This change of polarity of the generator fields results in a reversal of the generator line current and consequently the direction of rotation of the motors.

OPERATION OF THE CONTROL EQUIPMENT

NORMAL OPERATION - PROPELLING

After bringing the Diesel-generator sets up to speed, make sure that the controlling rheostat is in the "off" position, then close in the "up" position the field and line switches of the motors and generators and finally the excitation switch.

The motors are now ready for starting by means of the controlling rheostat, either from the engine room or the pilot house. With the rheostat in the "off" position, the operator should note the reading of the motor field ammeter to see that the motor fields are properly excited. In this position the total current to the two fields should be approximately 68 amperes. The overload relay is also in the "reset" position and will stay so unless tripped out by excessive current. On the first step of the rheostat either to the right



147822 CR-8020 CONTROLLING RHEOSTAT. DL-2091981. FOR BOAT CONTROL. OUTLINE K-2092439. CONNECTIONS K-2092434. WITH COVER REMOVED. FRONT VIEW.

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or left of the "off" position the generator fields are energized. The field current is gradually increased as the handle is moved further along from the "off" position. With normal voltage on each generator, the total current of the generator fields should be about 55 amperes. The full load current value of the system is 1065 amperes and this amount should not be exceeded when bringing the motor up to speed.

Set the generator field adjusting rheostats when the controlling rheostat handle is in the position giving 230 volts so that the line voltage of each main generator will be the same. This adjustment should maintain for normal conditions of operation.

The motor field rheostat should be adjusted to give the normal propeller speed when the controlling rheostat handle is in the position to give 230 volts on each machine. To reverse the motor it is necessary to move the controlling rheostat handle in the opposite direction.

NORMAL OPERATION - PUMPING

Either or both main generators may be used to supply power for the pump motors, one generator being connected to the upper bus of the Cargo Pump Panel and the other generator to the lower bus. The power lines to the cargo pumps are connected to the middle terminals of double pole, double throw switches, the upper terminals of which are connected to the upper bus and the lower terminals to the lower bus. By this arrangement of switching any pump can be supplied by any generator. The switching operation necessary on the Main Propulsion Panel to supply the Cargo Pump Panel consists of closing the generator field switches in the "down" position and then closing the excitation switch. All other switches should be open and the controlling rheostat should be in the "off" position. The generators are protected from excessive overload by circuit breakers mounted on the Cargo Pump Panel supplied by the customer. The line voltage of each generator should be adjusted by means of their respective field rheostats mounted on the control panel so as to give a line voltage of 230 volts.

COMBINED OPERATION - PROPELLING AND PUMPING

If at any time it should become necessary to operate the pumping machinery and also propel the boat, this can be accomplished by dividing the system, using one generator for supplying the pumps and the other for the propelling motors. In this case the LINE and FIELD switches of the generator chosen to supply the Pump Panel should be thrown in the "down" position, the other switching connections remaining the same as for propelling.

EMERGENCY OPERATION

If for any reason one of the main generators or motors should be inoperable, various combinations of switching can be used to remove the disabled machine from the circuit.

If one generator is disabled it can be removed from the circuit by throwing its LINE switch to the "down" position and by opening its FIELD switch. The EXCITATION SWITCH should always be opened before making any change in the control switching.

If one of the motors is disabled it can be removed from the circuit by throwing its LINE switch to the "down" position and by opening its field switch, again observing the above caution. Only one generator should be used when one propelling motor alone is operating since the line voltage with both generaters connected in, is twice that of a single motor.

EXCITER AND AUXILIARY GENERATOR PANEL

This panel is supplied by the customer, and the switching operations necessary to supply the various busses will be apparent by referring to the System Wiring Diagram in the back of the book. Either or both of the main exciters can be switched on to the bus which supplies power for the excitation and control circuits of the main propelling machinery and also power for lighting and the auxiliaries. In the foregoing paragraphs on various operating conditions, it is assumed that the excitation bus will be kept "alive" by either (or both exciters) as the condition requires.

OPERATING SUGGESTIONS

1. Always move the controlling rheostat to the "off" position and open the excitation switch on the Main Propulsion Panel before switching.

2. If the cargo pumps are in operation and it is necessary to make changes in the control panel switching, the motor pump switches should be opened before closing the excitation switch, and the pumps again started individually.

3. Observe the various instruments when staring and reversing so as not to exceed the full current values. In reversing if this is disregarded, the excessive load might trip out the overload relay thereby opening the field contactor resulting in loss of the braking effect of the motors during the time required to reset the relay and bring up the motor speed.

MAINTENANCE OF THE CONTROL EQUIPMENT

The frequency and thoroughness of inspection necessary to keep the control equipment in the best of operation depends largely on the operating conditions. While casual inspections naturally occur from ones interest in the machinery it is very essential for consistent operation that a thorough inspection be made about once a month. After a run, examination should be made for any overheated points or contacts which will indicate imperfect connections.

OPERATING TESTS

At each inspection the controlling rheostat should be tested over its entire range of operation, observing the performance of the contactor and relay and the continuity of increase in the line voltage. Inspection can be made under normal conditions of operation, making observations of the various parts during the various positions of the controlling rheostat. With the control arm turned only one or two points from the "off" position trip out the overload relay by hand, advance the handle farther around, and then bring it back to the "off" position. The relay should not reset until the contact arm comes back to the top center segment of the controlling rheostat. See that the line voltage reverses when the contact arm passes this position.

INSPECTION

At each inspection all parts of the apparatus should be examined, cleaned, adjusted, and oiled, or if necessary, repaired, and observation made of the following points:

CONTROLLING RHEOSTAT

(a) Inspect the contact arm for tight plungers which might make poor contact if there were any low spots in the rings, for imperfect contact and loose connections.

(b) When dirty, clean the plungers and rings and apply a small quantity of lubricating oil to the contact surfaces with a piece of cheesecloth.

(c) The condition of the controlling rheostat resistance can best be determined by observing the manner in which the voltage builds up and reverses when conducting the "Operating Tests".

(DB-285-A5 CONTACTOR.) The cable connections to the contactor and overload relay should be examined to insure that they are tight and have not become overheated during operation.

The contactor and relay should be inspected and properly maintained by observing the following:

(a) Examine the contact tips and tighten the holding screws if loose.

(b) Renew contact tips when worn half through.

(c) When renewing a contact tip, if the surface against which it rests has become rough or pitted, due to poor contact form a loose screw or similar cause, it should be made smooth.

(d) The contact tips close with a butting and rolling movement which tends to remove any roughness caused by arcing. If, for any reason, the tips become extremely rough, they should be filed smooth.

(e) The screws holding the contactors in place should be examined to see that they are tight.

(f) The pigtail shunts should be examined for wear and breakage.

(g) Examine the arc chute sides. When they are one-half burned through, they should be replaced by new ones.

(h) Inspect for loose or missing nuts and screws, broken or not split cotter pins, and broken springs.

DB-811-B3 OVERLOAD RELAY

(a) Keep the contact points clean.

(b) Trip the relay occasionally and see that the armature moves freely.

LAYING UP

If it should become necessary to "lay up" the tanker for a y considerable time, the following precautions should be observed to prevent unnecessary deterioration of the electrical machinery:

(1) Remove all oil and other dirt deposits from the windings by means of carbon tetrachloride. Carefully dry the windings to remove any of the cleaning fluid and where it appears necessary apply GE #458 black varnish to protect the insulation. This also applies when the machinery is not laid up, for the windings must be kept clean at all times so as not to impair the insulation.

(2) Protect the bearing journals from rusting by either coating them with a heavy oil or by frequently turning over the machinery.

(3) Lift the brushes from the commutator to prevent accumulation of moisture at the point of contact and consequent corrosion.

(4) To facilitate cleaning the armatures and pole-pieces, it may be found advantageous to remove the upper half of the magnet frame and the entire brush holder rigging. Be sure to disconnect the pole connections from the pole-pieces on either side of the joint before lifting the frame.

(5) In order to prevent the accumulation of moisture in the windings, it is suggested that the electrical machinery be covered and a few lamp bulbs placed in each machine to keep the temperature slightly warmer than that of the surrounding air.

RECOMMENDED PROCEDURE FOR DRYING OUT AND TESTING THE INSULATION RESISTANCE OF THE GENERATOR AND MOTOR WINDINGS.

INSULATION RESISTANCE

Although the generators and motors are provided with waterproof insulation, this insulation should be kept dry, and after standing for a long time, either during the period of installation or during interruption of service after installation, the insulation and also other parts are likely to become covered with moisture to a certain extent, and possibly the terminals or other exposed parts may become dirty, which will tend to reduce the insulation resistance and make it unsafe to operate at the full potential. In order to determine the condition of the insulation its resistance should be measured.

The insulation resistance can be readily measured by the use of a megger, which gives resistance in megohms. When this is not available the insulation resistance may be measured by means of a high resistance direct current voltmeter. The deflection of the meter is directly proportional to the current flowing through it and inversely proportioned to the resistance of the circuit with constant potential across it.

• In this installation, if direct current is not available from the shore, the auxiliary generator can be used to supply 115 volts to measure the insulation resistance of the generators which can then be alternately used if found satisfactory to supply 460 volts for measuring the insulation resistance of the motors and also the exciters.

To test for insulation resistance, attach the voltmeter directly across the terminals of the supply line and note the reading. Never use a voltmeter whose scale registers lower than the voltage supplied. The resistance to be measured is next connected in series with the voltmeter and a second reading taken and noted.

The resistance "X" is then given by the formula:

$$\frac{Rm}{Rm + x} = \frac{Dm}{V} \quad \text{whence } Rm + x = \frac{VRm}{Dm}$$

Where Rm = Resistance of the voltmeter used
Dm = the deflection of the voltmeter with the resistance in series

V = the voltage supply when taking the reading Dm
X = the insulation resistance sought

In making this test first determine whether either side of the circuit is grounded or has a low insulation resistance by connecting the voltmeter between each side of the supply circuit and ground. Next connect the line of lower insulation resistance to the frame of the motor or generator to be tested through a fuse of 5 or 10 amperes capacity or a resistor of from 100 to 500 ohms such as an incandescent lamp. Failure to observe this precaution may result in personal injury. One terminal of the voltmeter should now be connected to the other line, and the remaining terminal of the voltmeter connected first to the frame of the machine to be tested to determine the voltage of the line "V" and then transferred to the winding whose insulation is to be tested. The resistance of the insulation will then be in series with the resistance of the voltmeter and the reading obtained when so connected will be small when the resistance of the insulation is high.

In accordance with the A.I.E.E. Standardization Rules, when the machine is dry and clean the insulation resistance in megohms should not be less than the voltage of the machine divided by the kilowatt rating plus 1000. That is the insulation resistance should be equal to or greater than

$$\text{Resistance} = \frac{\text{Rate voltage}}{\text{Rated Kw. plus 1000}}$$

TO DRY OUT THE WINDINGS

The following procedure is recommended to dry the windings electrically:

(1) Secure the ship as for a dock trial.

(2) Prepare to operate as for normal operation.

(3) Increase the generator voltage by moving the controlling rheostat so that the line voltage does not exceed 25% of normal voltage.

(4) The controlling rheostat handle should be set for either ahead or astern operation, depending on the position of the boat in the dock.

(5) The temperature of the windings should not attain 85 deg. C (185 deg. F) in less than two hours and should never exceed this temperature during the drying out process.

(6) Continue this drying out process until the insulation resistance is equal to or greater than the amount previously given.

(7) While various methods of drying out might be possible with this apparatus, no method should be used in which the armature is not allowed to revolve since local heating at the brushes might cause warping of the commutator.

HOW TO ORDER SUPPLY PARTS

When ordering supply parts for the generators, motors, or control equipment, the following data should always be given:

(1) Name of the ship.
(2) Complete address where shipment of parts is to be made.
(3) Complete data as given on the nameplates of the turbine, gear, generator, exciters, motor or control equipment.

NOTE: The serial numbers of the generators and motors are also stamped underneath the nameplate.

(4) Complete description and the use of the part wanted.

(5) Any stamped data that may appear on the original part.

(6) Should the blueprints which are supplied with the equipment be available the drawing number and part number, as given on the drawing, should also be given.

(7) Parts forming one completely fitted working part of assembled stock group should be ordered together, e.g., upper and lower halves of bearings, shafts, and bushings, etc..

Should any uncertainty exist as to exactly what is required a sketch of the part wanted, giving all necessary dimensions, should accompany the order. Attention to the above will greatly expedite the shipment of orders for supply parts.

GENERAL ELECTRIC COMPANY

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R. H. Parker, Local Manager
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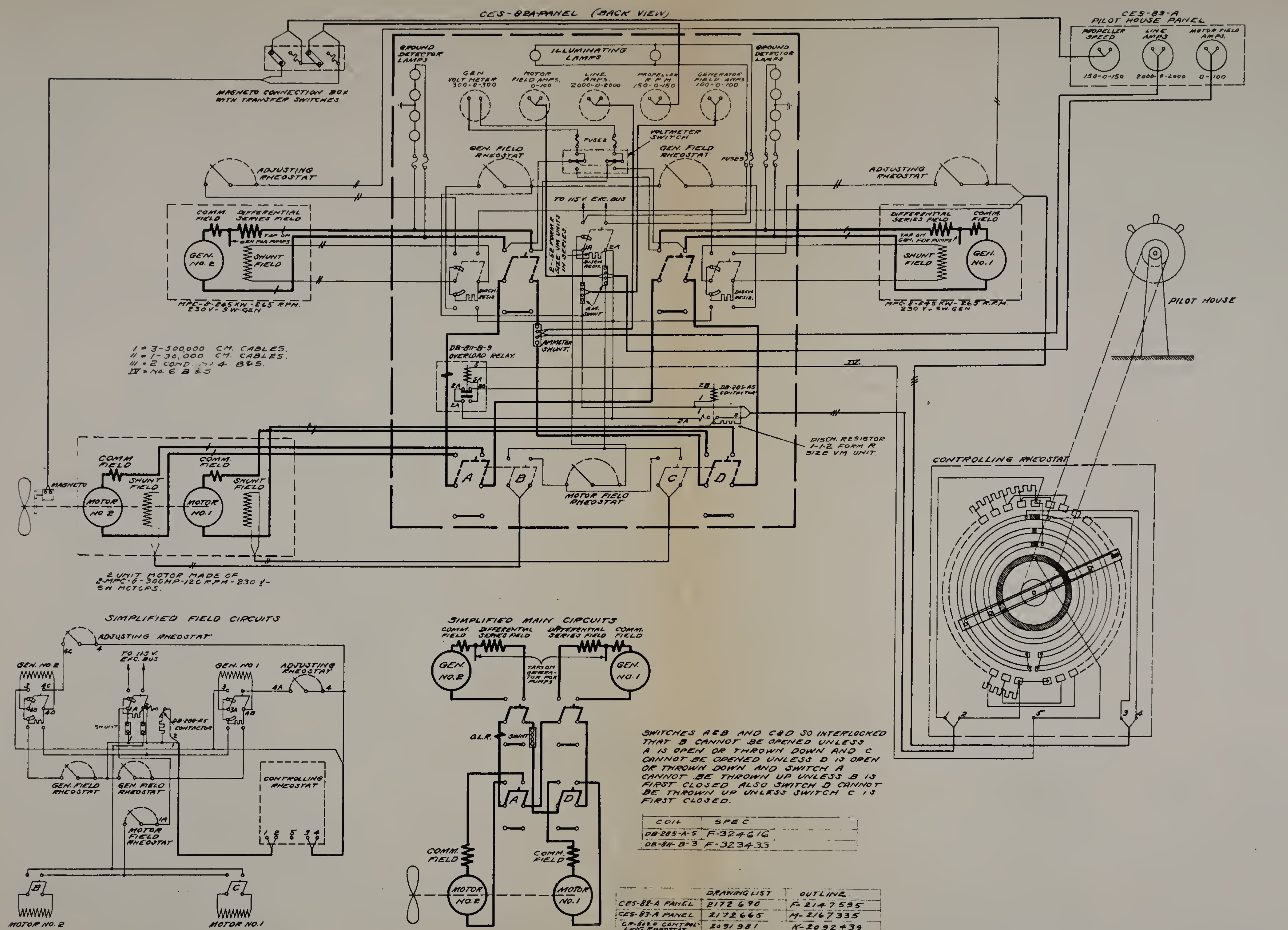
A. L. Pond, Local Manager



I = 3-500,000 C.M. CABLES.
II = 1-30,000 C.M. CABLES.
III = 2 COND. No 4 B&S.
IV = No. 6 B&S

SWITCHES A&B AND C&D SO INTERLOCKED THAT B CANNOT BE OPENED UNLESS A IS OPEN OR THROWN DOWN AND C CANNOT BE OPENED UNLESS D IS OPEN OR THROWN DOWN AND SWITCH A CANNOT BE THROWN UP UNLESS B IS FIRST CLOSED ALSO SWITCH D CANNOT BE THROWN UP UNLESS SWITCH C IS FIRST CLOSED.

COIL	SPEC.
DB-285-A-5	F-324616
DB-811-B-3	F-323433

	DRAWING LIST	OUTLINE
CES-82-A PANEL	2172690	F-2147595
CES-83-A PANEL	2172665	M-2167335
CR-8020 CONTROLLING RHEOSTAT.	2091981	K-2092439
CR-8020 GEN. FLD. ADJ. RHEOSTAT.	2097093	K-1876872

④	JAN. 5. [illegible] V. Gecr.	CHANGED TYPE OF PANEL TO CES-82-A- CHANGE CONNECTIONS ON CES-82-A PANEL — ADDED NOTES.
③	OCT. 10-22 T.J.HOPKINS JR.	CHANGED LOCATION OF AMMETER SHUNT & O.L.R. ON CES-82 PANEL.
②	AUG 16-22 V. Gecr.	CHANGED RATING OF DB 285 A5 CONTACTOR-ADDED DISCHARGE RESISTOR, TAPS ON GENERATORS FOR PUMPS AND PANELS
①	AUG-16-22 V. Gecr.	ADDED CABLE MARKINGS. CHANGED RATING OF DB.285 CC FROM A TO B. ADDE. RESISTOR.

CONNECTIONS

DIESEL-ELECTRICALLY PROPELLED TANKER WITH
2-245 KW.-230 VOLTS-265 R.P.M. DC GENERATORS
AND ONE DOUBLE ARMATURE 600 H.P.-460 V.-130 R.P.M. MOTOR
GENERATOR FIELD CONTROL

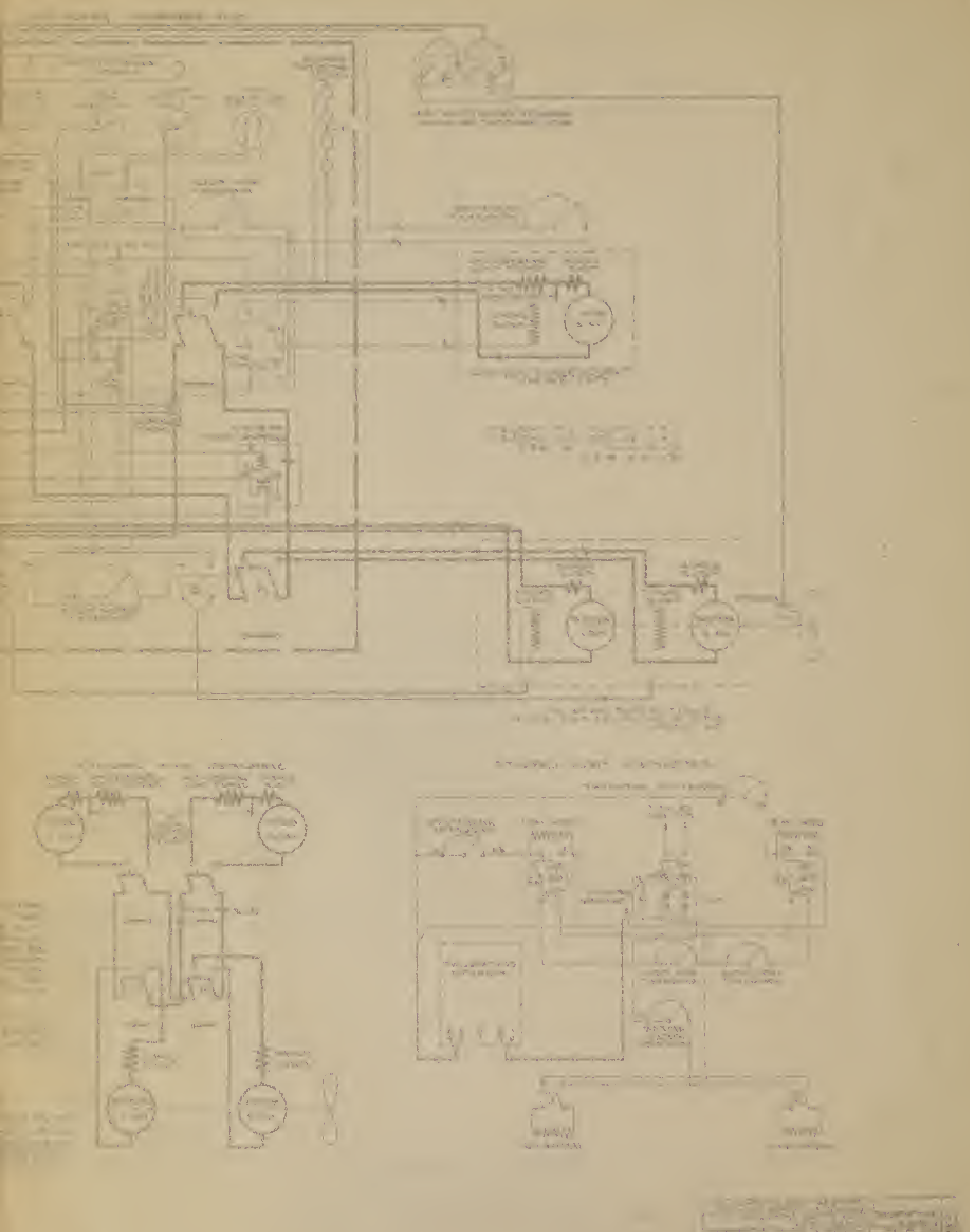
FIRST MADE FOR STANDARD OIL COMPANY OF CALIFORNIA.

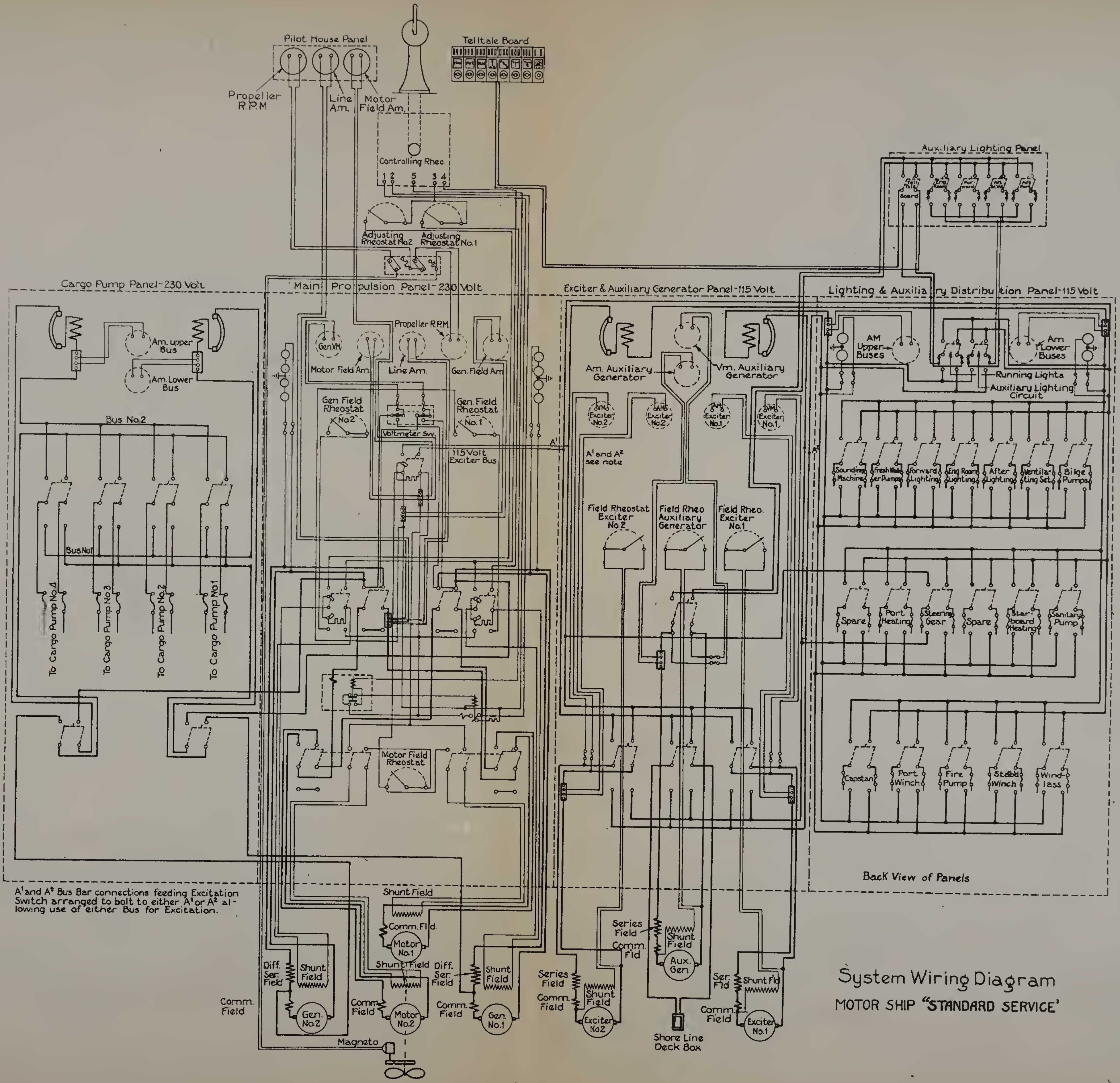
BEGUN BY T.J.Hopkins Jr. July 19.'22.
TRACED BY T.J.Hopkins Jr. July 24.'22
FINISHED BY T.J.Hopkins Jr. July 24.'22
INSPECTED July 27-22

GENERAL ELECTRIC CO.
SCHENECTADY N.Y.

P-2191313

PC





A1 and A2 Bus Bar connections feeding Excitation Switch arranged to bolt to either A1 or A2 allowing use of either Bus for Excitation.

System Wiring Diagram

MOTOR SHIP "STANDARD SERVICE"

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